Project Title	Drought Management Synthesis: Lessons learned from drought-related management actions on the Delta ecosystem, water supply, agriculture, and economy
Grantee	UC Davis Center for Watershed Science
Project Summary	California has just experienced one of the most severe drought periods in recorded history. The years between 2012 – 2016 set records for high monthly temperatures, low snowpack, and dismal reservoir levels. Such periods of drier-than-normal conditions that result in water-related problems[1], however, are relatively common in California. It is surprising then, that despite the relatively recurrent nature of drought in California, most State management actions in response to past and current droughts have been reactive rather than far-sighted and deliberate. Long-term thinking with respect to water management is especially important in the Sacramento-San Joaquin Delta, a region central to California's water supply needs and habitat for several native, endangered, and migratory species. Although project-specific drought contingency plans exist, no guiding document provides managers and scientists with lessons learned from the past drought to offer insights for future management and planning. The critical need for such information is widely accepted among managers for the Delta and is highlighted in the 2015 High-Impact Science Actions (HISA) topic 1A (see Management Relevance section for more information). The purpose of this effort is to develop a concise synthesis report based on the most up to date scientific information associated with drought-related management decisions made during water years 2014-2015 (chosen because these represent the most severe years of the recent drought period) that could serve as best available science to inform future drought-related management decisions. The report will employ existing scientific monitoring data, analyses and research findings so managers can use this information to: o evaluate ecological and water supply outcomes of past actions made in response to and in preparation for the drought. o identify joint agency science actions that would improve natural resource management in future droughts. Although the focus audience will be decision makers including local and regional managers responsible for water operations, monitoring programs, and implementing regulation affecting water supply, the goal is to also provide scientist and stakeholders with information about critical knowledge gaps and additional research, monitoring, and data analysis required to support future decisions. The report will be structured around key aspects of the Delta that have been affected by the drought and related management actions in an effort to examine how conditions and management actions interact broadly

	across the Delta systems. Major focus areas will include the Delta ecosystem, water supply, and agriculture and economy. Specific questions will be addressed with respect to key management actions outlined below. Answers to these questions will provide information regarding the science used to both anticipate and determine actual outcomes of management actions, and provide insight into additional research and monitoring necessary to better support future drought-related management decisions. Key Management actions will include those related to: ○ Delta inflow modifications including water temperature management below upstream reservoirs ○ Within-Delta flow and water quality (salinity) modifications ○ Water operation modifications including reservoir management ○ Delta export volume and flow modifications ○ Modifications to federal and state fish hatchery operations ○ Aquatic vegetation mitigation (invasive weeds related to recreation, water operations, and habitat) ○ Harmful Algal Bloom management We will be taking advantage of the expertise offered by staff from the University of California, Davis Center for Watershed Science (CWS) to take on this synthesis task. The CWS is an institute dedicated to the interdisciplinary study of critical water challenges, particularly in California, focusing on environmentally and economically sustainable solutions for managing rivers, lakes, and estuaries and is thus well versed on subjects pertaining to the effect of drought on the Delta ecology, agriculture, economy, and water supply. Although rains have returned, the next drought cycle is inevitable. The timing of this lessons learned document therefore, is critical for managers and scientists to consider in preparation for future decisions related to drought. [1]United States Geological Survey definition of drought. California Drought Page https://ca.water.usgs.gov/data/drought/
Key Questions	The synthesis document will provide information that answers the following questions related to key management actions listed in the Project Summary: 1. What were the expected outcomes of the management action and what science was used to predict these outcomes? What science was used to determine the actual outcome? 2. How were any unanticipated outcomes determined and were the scientific tools used effective and necessary? 3. How were the outcomes (anticipated and unanticipated) factored into subsequent management actions?

	4. Had the management action not occurred, what does our current information (i.e., not necessarily limited to information available at the time) indicate would have happened to the Delta environment? 5. In a similar future situation, what additional information would have been useful in evaluating potential outcomes in advance and determining actual impacts? 6. How can we identify and evaluate the likelihood of outcomes of this management action over the long-term? Are some of these science actions already in place?
Management Relevance	This effort will produce a guiding document that provides both managers and scientists with lessons learned from the past drought to offer insights for future management and planning and is directly related to the high-impact science actions (HISA) Topic 1A: *Conduct a technical review of current reports concerning the drought to identify what is known about effects of the drought as well as to determine gaps in knowledge and topics not covered in past synthesis efforts. Using results from the review conduct a "lessons learned" workshop and create a set of metrics to monitor key indicators of drought impacts*. The HISA identifies a short list of high-impact, multi-benefit science actions that would fulfill cross-agency needs in the Delta within a two-year time frame.
Deliverables	1. Synthesis report 2. Public communication of report (suggested formats include a workshop and public presentations).
Anticipated Start Date	May 1, 2017
Anticipated End Date	February 2018
Project Manager	Yumiko Henneberry